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FROM A DISSOCIATIVE TO A TRANSCENDENT STATE: AN EEG DEFINITION OF THE HEMI-SYNC® PROCESS

by F. Holmes Atwater

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Abstract

This paper discusses an EEG definition of the Hemi-Sync process from the dissociative state into transcendent states and their experiences. A Hemi-Sync index based on brain-wave synchrony in response to multiplexed binaural beat frequencies is proposed. The role of alpha brain-wave suppression in relation to the development of these states also is considered. A commentary, including protocols, data analysis, and illustrations of initial results of ongoing research, is included.

History

For years researchers associated with and those independent of the Institute have been in search of an objective way to measure and appraise something known as the Hemi-Sync process. Most researchers have chosen the electroencephalograph (EEG) as their instrument or device to conduct these objective observations. Conventional research protocols called for these researchers to look for classic evoked-potential EEG responses to binaural beat stimuli. Failing in their efforts to observe a so-called direct response to Hemi-Sync, these well-intentioned researchers were forced by their own findings to conclude that the binaural sound patterns of Hemi-Sync had no observable effect on brain waves. A 4 Hz binaural beat signal did not present a classic evoked-potential 4 Hz EEG response.

In 1988 The Monroe Institute acquired a computerized EEG recording device, the LEXICOR Neurosearch-24 (NRS-24). The NRS-24 provided EEG data acquisition, analysis, and display. The EEG research that we began at that time was not designed in form and protocol to ensure acceptance by orthodox segments of our culture. It was obvious that the Hemi-Sync sound patterns worked; there had been literally thousands of individuals who *knew* from their own experience that this was true. The Institute confirmed what other researchers had found: Conventional EEG evoked-potential protocols simply did not provide any information about how Hemi-Sync was affecting the brain. The Institute was not bound, however, by the often narrow confines of convention. The Institute chose to observe brain-wave activity openly with

the highly versatile NRS-24 and wait for patterns to emerge. Later, more traditional scientific protocols were used to validate hypotheses developed. Through this process, objective evidence of the effect of Hemi-Sync sound patterns on the brain has emerged.

The Dissociative State

During what is termed normal waking consciousness, nonphysical phenomena generally remain at the unconscious level. When perceptions of the nonphysical intrude into what is otherwise occupied with sensory data about the physical world, an opening is experienced. This, however, is not classified as a dissociative state. Only when nonphysical phenomena constitute the whole field of perception, when there is no impression of being “normally” in the physical body, when the physical body is asleep or fully entranced, then together these constitute a dissociative state.

In terms of EEG, the shift from normal waking consciousness into a dissociative state is evidenced by a change in amplitude, frequency, and locale of predominant brain waves. Looking at the bipolar electrode position C3-C4 (the median of the central cortex), the waking state is characterized by alpha and beta brain waves. The dissociative state is characterized by relatively high-amplitude slow-wave (delta and theta) activity.

Sleep is a dissociative state. Deep meditative states and some trance states can also be classified as dissociative states (Figure 1). In the case of the latter, synchrony of brain-wave activity is increased. This brain-wave synchrony can be seen at the bipolar C3-C4 electrode site.

The shift in consciousness from the waking state into the dissociative state is accompanied by another EEG phenomenon called alpha suppression. Alpha brain-wave activity confined to the cortex behind the Sylvian sulcus, the back of the head, is known as “resting-state-alpha.” As one moves toward a dissociative state, alpha activity in this region is suppressed.

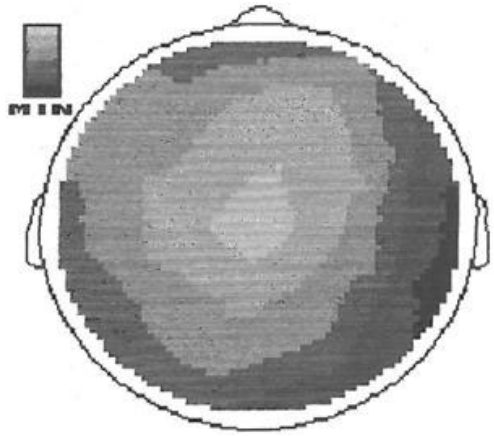

Figure 1: The Dissociative State

The suppression of this alpha activity frees one to perceive nonphysical energies outside the confines of physical-law belief systems.

The Transcendent State

Beyond dissociation is transcendence. The transcendent state can be defined as outside the normal limits of one's ego and one's personal unconscious mind, into universal awareness. Experiences in this state are many times ineffable. Experiences in this realm are more than passive diversions. Their creative power can change the very nature of the participant's reality.

Figure 2: The Transcendent State

In terms of EEG, the shift from a dissociative state into transcendence is evidenced by further changes in amplitude, frequency, and locale of predominant brain waves. The transcendent state is characterized by relatively high-amplitude slow-wave (delta and theta) brain waves, but

this is accompanied by regional (usually temporal) gamma wave activity (Figure 2). There is evidence that brain-wave synchrony is increased during experiences in transcendent states. The shift in consciousness from the dissociative state into transcendence is also evidenced by continued alpha suppression.

The Hemi-Sync Index

BioLex V200 software for the NRS-24 has enabled the development of a Hemi-Sync index, an objective measuring device which demonstrates the brain-wave response to Hemi-Sync sound patterns. This index is a complex combination of parameters heretofore unrealized in conventional EEG records. The first component of this index is frequency. Brain waves must first be of the same frequency to be considered potentially synchronous. The second element of this index is phase-angle symmetry. Brain-wave synchrony is defined as having brain waves of equal frequency and phase angle. Frequency and phase angle are easily derived with Fast Fourier Transform (FFT) mathematics.

Synchrony alone, however, is insufficient to define the Hemi-Sync index. Even though brain waves may approach 100% synchrony, they may be of so low an amplitude that they have little or no significant relationship to the brains overall functions. Remembering too that a shift into a dissociative state and later into a transcendent state is accompanied by higher-amplitude slow-wave activity, the formula for a Hemi-Sync index is frequency equality plus phase-angle equality multiplied by the amplitude in microvolts of slow-wave activity. The NRS-24 BioLex V200 software enables determination of this derived parameter through simple user programming. By entering the derived parameter, “synch(band)*band,” the software will compute and display the Hemi-Sync index. The index can be measured from the bipolar C3-C4 electrode.

Alpha Suppression

Hemi-Sync (the mixing of a number of binaural beat frequencies) generates an audioencephalographic-interferometry effect which can be used to transform or suppress innate resting-state-alpha [Ed.: Also see HEMI-SYNC® JOURNAL, Summer 1992, Vol. X, No. 3) *Laboratory Evaluation - The Efficacy Of Hemi-Sync Frequencies*]. Some “Focus level” Hemi-Sync frequencies used do not interfere with resting-state-alpha and allow the listener to integrate and relate to “tape experiences” in his or her everyday, familiar life. Other Hemi-Sync frequencies endeavor to alter or suppress resting-state-alpha to provide listeners with high-fidelity, rich “Focus level” dissociative states and transcendent experiences. This alpha suppression can be seen in NRS-24 topographs and, with the advent of the new BioLex V200 software, can be quantified and graphed.

ONGOING RESEARCH

Introduction

It was stated earlier that well-intentioned researchers failed in their efforts to observe a so-called direct brain-wave response to Hemi-Sync. Simply stated, a 4 Hz binaural beat signal did not present a classic evoked-potential 4 Hz EEG response. This evoked-potential hypothesis, however, was flawed from the onset. The lower auditory centers of the brain provide the neural pathways for the generation of binaural beats. It is there, in each hemisphere's olivary nucleus, deep inside the brain, that beat-frequency oscillations can be measured directly. At the cortex, the site of EEG electrodes, these original binaural frequencies can only be observed as having been integrated with prevailing electroneural activity. It is the entrainment that occurs during this integration process that accounts for the effectiveness of Hemi-Sync sound patterns. Applying a more sophisticated investigative paradigm than that of simple evoked-potential protocols, *objective EEG evidence of the effect of Hemi-Sync binaural beats has been established*.

Procedure and Method

A series of volunteer subjects is being studied. All volunteers are being examined while listening to the same series of sounds through piezoelectric stereo headphones, lying supine on a waterbed in an isolated, shielded environment. Volunteers are instructed to attend to sounds over a period of approximately forty-five minutes. Volunteers are connected to a 20-channel, computerized EEG (Neurosearch-24, LEXICOR, Boulder, Colorado), using V151 software. The entire 10/20 International system of electrodes is being used (Electro-Cap), with linked ears serving as reference and the midline vertex as a ground. An AB^NA experimental protocol is being used. Ninety seconds of EEG data are being collected at baseline (without sound), during stimulation of a series of experimental Hemi-Sync tones, and postbaseline (without sound). The NRS-24 sampling rate of 256 Hz is being used, which provides for a brain-wave frequency response of 1 Hz-64 Hz, a frequency resolution of 1 Hz, and a temporal resolution of one second. Subjective reports of experiential content are obtained both during stimulation, when appropriate, and at a debriefing session at the end of each experiment. All EEG data is recorded and saved on an IBM-compatible 386 AT computer in raw form accessible only by LEXICOR's proprietary software and hardware.

Volunteers

The volunteer pool includes adult males and females, aged twenty to eighty. Familiarity with Hemi-Sync ranges from naive to adept.

Data Analysis

All data is screened for movement artifacts; those epochs demonstrating artifact levels exceeding 30 microvolts of delta at bipolar site C3-C4 are discarded from analysis. For each volunteer's data, each ninety-second recording period is then subjected to an FFT analysis of the EEG activity at bipolar site C3-C4 to determine the fluctuations of individual frequency bands over time and across varied stimuli. The analysis is computed by taking the FFT of a single epoch of data (one second), then summing the values within the range of frequencies corresponding to each band. Average amplitude in microvolts of delta (0 Hz-4 Hz), theta (4 Hz-8 Hz), alpha (8 Hz-13 Hz), and beta (13 Hz-20 Hz) is computed.

Two designated derived parameters are computed simultaneously with the above FFT analysis. The first of these is the Hemi-Sync index, "synch(delta)*delta." The second is an alpha-suppression algorithm, "% alpha2." A graph of these two derived parameters is then constructed, extending from baseline across varied stimuli to postbaseline. This graph is examined to substantiate the hypothesis that Hemi-Sync binaural beat stimuli engender elevated-amplitude slow-wave EEG synchrony and that this effect may be inversely proportional to the suppression of resting-state alpha. Individual ninety-second recording periods can also be graphed and scrutinized to substantiate the same hypothesis.

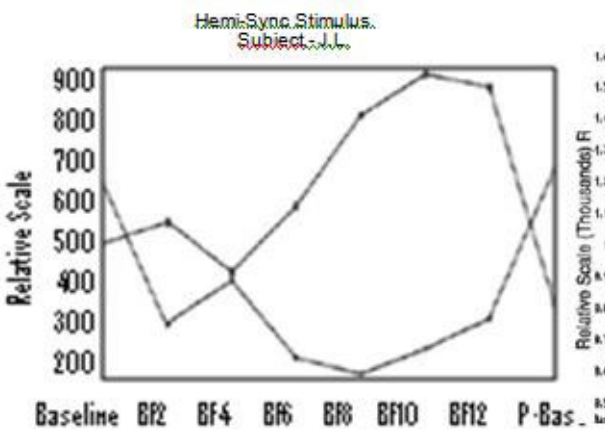

Figure 3

Bipolar Electrode Site C3-C4
Hemi-Sync Index + % Alpha²

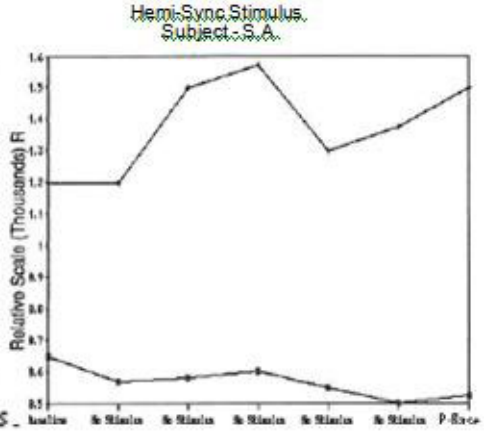

Figure 4

Bipolar Electrode Site C3-C4
Hemi-Sync Index + % Alpha²

Results

Significant alterations in EEG frequency, amplitude, and synchrony at bipolar site C3-C4 are being observed. When compared to baseline, postbaseline, and a control trial, the Hemi-Sync index indicates elevated-amplitude slow-wave EEG synchrony during periods of Hemi-Sync stimulus. Alpha suppression appears related to Hemi-Sync stimulus as well. Individual ninety-second recording periods provide a closer look at the relationship between elevated-amplitude, synchronous slow-wave EEG activity and alpha suppression. Figure 3 shows the Hemi-Sync

index and related alpha suppression from baseline, across varied Hemi-Sync stimuli, to postbaseline.

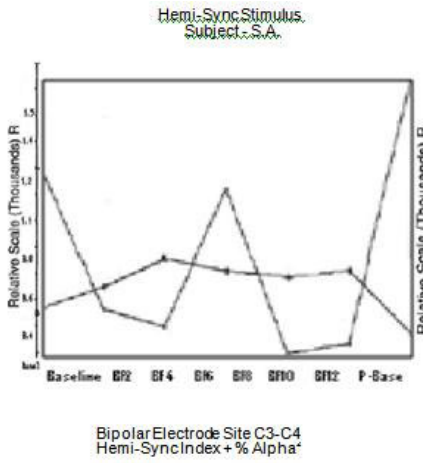

Figure 5

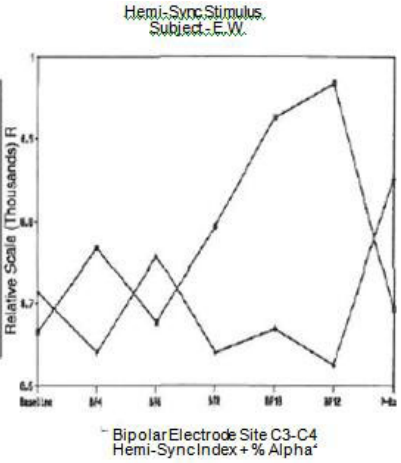

Figure 6

This subject appears to have regressed slightly into resting-state-alpha during Hemi-Sync stimulus BF4. The Hemi-Sync index is at its highest point during stimulus BF10. Before illustrating more ABNA protocol subjects, examining a control trial is valuable. In Figure 4, the subject is not provided with any Hemi-Sync stimulus. As you can see, there is no significant increase in the Hemi-Sync index and there is no alpha suppression. In Figure 5, this same subject, on another day, was exposed to the experimental Hemi-Sync stimulus. This subject appears to have awakened somewhat during BF8. With the next subject (Figure 6), a now familiar pattern of inversely proportional indexes demonstrates objective EEG evidence of Hemi-Sync influence once again. After a slight regression during BF6, the subject moves deeply into the Hemi-Sync environment. The next subject's record shows a similar pattern (Figure 7).

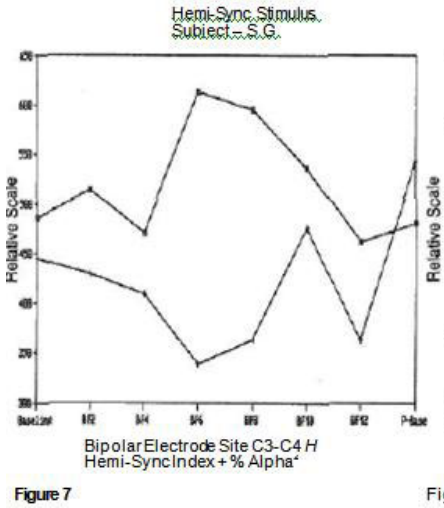

Figure 7

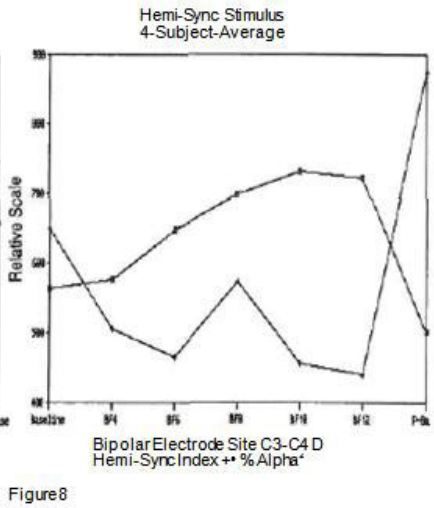

Figure 8

There is an awakening during BF10 and the deepest state occurs during BF6. To get an overall impression of how Hemi-Sync affects the total volunteer subject population to date, it is possible to average all subject data and plot a graph. Figure 8 illustrates that Hemi-Sync stimulus induces elevated-amplitude slow-wave EEG synchrony and that this effect is often inversely proportional to the suppression of resting-state-alpha.

Summary

A brief history of Hemi-Sync EEG research showed that classic evoked-potential protocols were inappropriate. Definitions of the dissociative state and the transcendent state were presented. A Hemi-Sync index was proposed. The role of alpha brain-wave suppression was also considered. Evidence was presented that supported the hypothesis set forth that Hemi-Sync stimuli induce elevated-amplitude slow-wave EEG synchrony and that this effect may be inversely proportional to the suppression of resting-state-alpha.